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PROBLEMS.

26. Proposed by J. W. WATSON, Middle Creek, Ohio.

Find the average area of all right angled triangles having a given hypotenuse.

27. Proposed by F. P. MATZ, M. Sc., Ph. D., Professor of Mathematics and Astronomy in New Windsor College, New Windsor, Maryland.

Find the mean area of the *dodecagonal surface* formed by joining in order the points taken at random, one in each sector of a regular dodecagon.

MISCELLANEOUS.

Conducted by J. M. COLAW, Monterey, Va. All contributions to this department should be sent to him.

SOLUTIONS OF PROBLEMS.

12. Proposed by F. P. MATZ, M. Sc., Ph. D., Professor of Mathematics and Astronomy in New Windsor College, New Windsor, Maryland.

If the measures of curvature and tortuosity of a curve be constant at every point of a curve, the curve will be a helix traced on a cylinder.

Solution by the PROPOSER.

A helix, inclination ω, traced on a right circular cylinder, radius r, is an unicursal curve, and may be defined by the equations $x=r\cos\theta\ldots.(1)$, $y=r\sin\theta\ldots.(2)$, and $z=r\theta\tan\omega\ldots.(3)$, in which θ is the angle through which the generating line has resolved when the point has moved through a space z on the generating line. From (1), (2), and (3), we have respectively

$$\frac{dx}{d\theta}=-r\sin\theta;\ d\left(\frac{dx}{d\theta}\right)=\frac{d^2x}{d\theta^2}=-r\cos\theta\ldots.(4),$$

$$\frac{dy}{d\theta}=r\cos\theta;\ d\left(\frac{dy}{d\theta}\right)=\frac{d^2y}{d\theta^2}=-r\sin\theta\ldots.(5),$$

$$\frac{dz}{d\theta}=r\tan\omega;\ d\left(\frac{dz}{d\theta}\right)=\frac{d^2z}{d\theta^2}=0\ldots.(6).$$

$$\therefore\ \frac{ds}{d\theta}=\sqrt{\left[\left(\frac{dx}{d\theta}\right)^2+\left(\frac{dy}{d\theta}\right)^2+\left(\frac{dz}{d\theta}\right)^2\right]}=\frac{r}{\cos\omega}\ldots.(7).$$

Dividing (4), (5), and (6), by the square of (7),

$$\frac{d^2x}{ds^2}=\frac{-\cos\theta\cos^2\omega}{r}\ldots.(8),\ \frac{d^2y}{ds^2}=\frac{-\sin\theta\cos^2\omega}{r}\ldots.(9),\text{ and }\frac{d^2z}{ds^2}=0\ldots.(10).$$

Since the reciprocal of the radius of curvature is the *measure of the curvature* at any point of a tortuous curve, we have